The Impact of Innovation on the National and Regional Competitiveness within the European Union

Alina Elena Iosif[1]

Abstract: Many studies have revealed the positive relationship between economic growth, and implicitly competitiveness, and innovation. The aim of the current paper is to test the impact of several indicators of innovation on the most relevant competitiveness indexes. These indexes are developed by the World Economic Forum, the Institute for Management Development or under the coordination of the European Union and their purpose is to quantify competitiveness. The current research is looking to the national and regional level within the European Union. In order to test the connection between competitiveness and innovation econometrical analyzes were carried out. Overall, the results indicated that indicators of innovation related to 'human resources', 'intellectual assets', and 'finance and support' have a positive impact on competitiveness. The differences and similarities between the impact of innovation on the national and regional competitiveness are pointed out. Knowing these particularities, the policy makers may formulate adequate national and regional policies to stimulate innovation. Several policy recommendations focused on the validated variables of innovation were formulated. The current paper brings an added value to the literature by revealing the positive connections developed between the most relevant indexes of competitiveness and indicators of innovation.

Keywords: indexes; rankings; policy recommendation

JEL Classification: O10; O30; O38

1. Introduction

The socio-economic changes have generated a new approach to economic growth, leading to the competitiveness between countries, regions, cities or enterprises (ESPON & Universidade de Santiago de Compostela, 2012). Emphasizing, the "economic competitiveness" is wide spread covering the enterprise level up to whole national economies (ESPON & Universidade de Santiago de Compostela, 2012). 'The ability to create more wealth than that created by competitors in the global market' is defined as the competitiveness of the national economy, while the competitiveness of cities and regions is focused on 'the ability to adapt to the

[1] Teaching Assistant at the Department of Business, Consumer Sciences and Quality Management, Academy of Economic Studies, Romania, Address: 6 Piaţa Romană, Sector 1, Bucharest 010374, O.P. 22, Romania, Tel.: + 4.021.319.19.00, Fax: + 4.021.319.18.99, Corresponding author: iosif.alinaelena@gmail.com.

changing conditions, while paying special attention to maintaining or improving one's position in the ongoing rivalry between regions and cities' (ESPON & Universidade de Santiago de Compostela, 2012, p. 6). Further on, competitiveness at the micro level refers to "*the ability of a firm to increase in size, market share and profitability*" (Fagerberg & Nelson, 2003).

The competitiveness is influenced by various factors, out of which innovation is one of the most important. Close to innovation, the location, specialization, and infrastructure are considered to be the other main factors that have impact on competitiveness (Becker, 2009). Similarly, Kumar et al. (2013) places innovation as one of the main drivers of competitiveness of emergent markets, next to internalization and institutions.

Innovation implies a "new or significantly improved product (good or service) introduced to the market or the introduction within an enterprise of a new or significantly improved process" (ESPON & Politecnico di Milano, 2012b, p. 11). Another definition of 'innovation' refers to 'the putting into practice of inventions' (Fagerberg et al., 2005 in Naude et al., 2011, p. 2). Innovation is divided into several divisions represented by the product innovators that have to introduce new and significantly improved products in terms of fundamental characteristics; the process innovators that have to implement new and significantly improved technologies in production or methods in supplying services and delivering products; and the marketing and/or organizational innovators that are focused on capturing innovation processes in services (ESPON & Politecnico di Milano, 2012b). Overall, innovation has a wide coverage referring to the development of new products, processes, exploitation of new markets and the development of new ways to organize business (Naude et al., 2011). More generally, "*innovation is an evolutionary, cumulative, interactive and feedback process in terms of information transfer, implicit and explicit knowledge in alterations of a technical and organisational character*" (Kroll et al., 2012, p. 13).

Radical innovation is associated to the advanced economies that are characterized by intense competition, while the incremental innovation is more relevant for developing countries that are in the process of catching up (Naude et al., 2011).

As stated by Moreno & Suriñach (2014), the relationship between innovation and growth is a subject that was intensively debated in the economic literature and the results revealed the positive impact of innovation on the economic progress. Innovation has an essential influence on fostering competitiveness, productivity and job creation (Romer, 1986 in Moreno, Suriñach, 2014). Apart of the significant impact of innovation on national economic growth, innovation is stimulating regional and local economic development (Kroll et al., 2012).

Both nations and regions are open systems that have either, to develop their ability 'to absorb and to fruitfully apply what is known elsewhere', or to develop leading-edge innovations in order to enhance competitiveness (Kroll et al., 2012). Overall, innovation is relevant for any country, region, city, no matter its level of development if it is interested to be competitive within the global economy.

The goal of this research paper is to determine, through econometric analyses, which are the main determinants of innovation that have a positive impact on national and/or regional competitiveness in EU. Knowing the determinants of innovation that have a noticeable impact on the increase in national and regional competitiveness is highly important for the formulation of policy recommendations.

The following section includes an overview on the main relevant indicators of competitiveness and innovation.

2. Competitiveness and Innovation – Metrics and Ranking

Capturing competitiveness and innovation in metrics is a laborious process that involves the use of various and relevant indicators in order to develop a complex instrument.

The three main instruments measuring national competitiveness are represented by the Global Competitiveness Index (GCI), the World Competitiveness Index (WCI), and the Country Competitiveness Index (CCI). These instruments have a certain history, as follows: the World Economic Forum is developing the report on competitiveness for 35 years (Schwab, 2014, p.xiii), the IMD World Competitiveness Center is declaring that they are the 'pioneers in competitiveness since 1989' (IMD, 2013), while the index elaborated by the Joint Research Center of European Commission has a second apparition, after the 2010 edition (Annoni & Dijkstra, 2013, p. 134).

The most recent published reports on competitiveness in relation to the current paper are reflecting the Global Competitiveness Index 2014-2015, elaborated by the World Economic Forum; the World Competitiveness Index 2014, released by the IMD Competitiveness Center; and the EU Regional Competitiveness Index 2013, which includes the Country Competitiveness Index 2013, elaborated by the Joint Research Center of European Commission. Apart of these, World Bank Group is making a ranking of the economies in terms of their ease of doing business. The reports entitled 'Doing Business' of the World Bank Group (2015) rank the economies based on their regulatory environment in relation to starting and operation of a local firm. The most recent ranking reflects the situation of 2014 and is referring to 189 economies.

Further on, a comparison between the rankings of the national competitiveness indexes is conducted. The EU Regional Competitiveness Index 2013 (Annoni & Dijkstra, 2013) includes the Country Competitiveness Index (CCI) that mostly reflects the situation for the year 2012. As it is the oldest reports compared to the others, 2012 will be considered the reference year. The comparing data will be extracted from the Global Competitiveness Report 2012-2013 (Schwab, 2012) and the IMD World Competitiveness Yearbook 2013 (IMD, 2013).

The Global Competitiveness Report 2012-2013 contains the ranking for 144 economies, while the IMD World Competitiveness Yearbook 2013 includes the hierarchy of 60 economies, without referring to Cyprus and Malta. The Country Competitiveness Index is dedicated to the ranking of the 28 Member States of the European Union.

As the ranking of a country vary for each index, mainly in terms of variables used and reference years, the comparison could be conducted only if the indexes are positioned on the same scale. The solution in this case would be to calculate the percentages of the rankings by 'dividing the rankings to the number of the economies used in each index' (Arslan, Tathdil, 2012, p. 40). For example, Belgium that is positioned on the 17^{th} position in the ranking of Global Competitiveness Report 2012-2013 that evaluates 144 economies, then its ranking percentage is of 11.81% (17/144*100). As a result, Belgium lies in top 11.81% of the 144 economies according to Global Competitiveness Report 2012-2013, 43.33% of the 60 economies evaluated in IMD World Competitiveness Yearbook 2013, and in the top 10.71% of the 28 Member States in terms of CCI 2013.

The graphic representation of percentages of the rankings for the year 2012 are captured in figure 1.

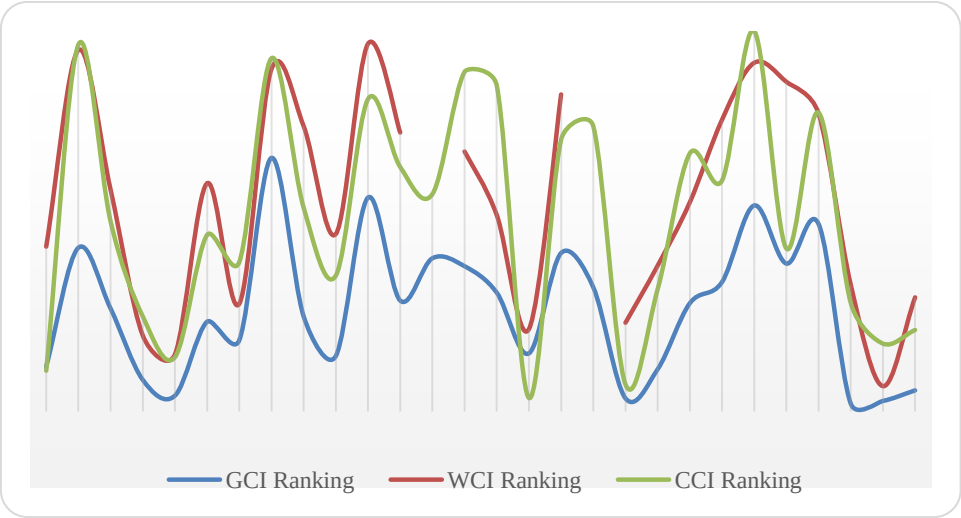

Figure 1. The percentages of the rankings for the year 2012

Source: own representation, based on the available data from various reports

Calculating the correlation between pairs of rankings, the results have indicated that the indexes are highly correlated. GCI and WCI have the tightest relation confirmed by the correlation coefficient of 90%, followed by the 88% connection between GCI and CCI, while WCI and CCI are connected in proportion of 84%. These highly positive correlations are explained through the use of similar variables or proxies in the composition of the competitiveness indexes (Arslan & Tathdil, 2012). Consequently, any of these three indexes could be a reliable source for measuring national competiveness.

Apart of the indicators that reflect the national competitiveness, there is the EU Regional Competitiveness Index (RCI) elaborated under the auspices of the Joint Research Center of the European Commission. This report is representative for capturing the competitiveness of 262 regions within the European Union. The current RCI 2013 represents the second edition of this index, reflecting data from the period 2009-2011. The highest competitive region out of the 262 regions of the European Union is Utrecht, followed by the London area and the area including Oxford (Annoni & Dijkstra, 2013, p. 132). On the other side, regions of Greece, Bulgaria and Romania are placed on the last positions in terms of regional competitiveness.

In terms of quantifying innovation at the national and regional level, the Global Innovation Index, the Innovation Union Scoreboard and the Regional Innovation Scoreboard are considered to be among the most reliable sources.

The Global Innovation Index 2014 reflects the situation in terms of innovation for 143 economies around the world and is constructed based on 81 indicators (Cornell University et al., 2014, p. xvii). The Global Innovation Index 2014 uses the most recent data, corresponding to the period 2004-2013. The 81 indicators are distributed within seven main categories and most of the data are reflecting the situation of 2010-2013 period. 56 indicators are represented through hard data, 20 represent composite indicators and 5 of them are survey questions from the World Economic Forum's Executive Opinion Survey (Cornell University et al., 2014, p. 373). A relevant index for measuring innovation at the European Union's level is represented by the Innovation Union Scoreboard 2014, which includes 25 indicators divided by eight dimensions. As 11 out of the 25 indicators mainly refer to the year 2012, and the others to 2009-2011 period (Hollanders & Es-Sadki, 2014), it can be concluded that this last version corresponds mainly to the year 2012.

Figure 2 reveals the main dimensions of innovation used for the development of Global Innovation Index (GII) and Innovation Union Scoreboard (IUS).

The Global Innovation Index	The Innovation Union Scoreboard
•Institutions •Human capital and research •Infrastructure •Market sophistication •Business sophistication •Knowledge and technology outputs •Creative outputs	•Human resources •Open, excellent and attractive research systems •Finance and support •Firm investments •Linkages&entrepreneuship •Intellectual assets •Innovators •Economic effects

Figure 2. Main dimensions of innovation included in GII and IUS

Source: own representation, based on the available data from various reports

The Regional Innovation Scoreboard (RIS) reflects the innovation at the regional level within the European Union. Due to the lack of data at the regional level only 11 indicators out of the 25 indicators inserted in the IUS are included within RIS. The RIS has a certain history, reaching the 6th edition in 2014. This last edition presents the innovation performance of 190 regions of the European Union, Norway and Switzerland associated to the year 2010. The regions are divided in the same four categories of innovation performance as in the case of the IUS, precisely

'innovation leaders', 'innovation followers', 'moderate innovators', and 'modest innovators'. The highest number of 68 regions are associated to the cluster of Regional Moderate innovators, while the lowest number of 31 regions are distributed in the cluster of Regional Modest innovators. The Regional Innovation leaders are mostly associated to the Innovation leaders mentioned in IUS, corresponding to Denmark, Finland, Germany and Sweden (Hollanders et al., 2014).

Based on the positive relation between competitiveness and innovation, the current paper settles several objectives, as follows:

- Identifying the main determinants of innovation that have an impact on the national competitiveness, represented by WCI, GCI or CCI, within the 28 Member States of the EU.
- Identifying the main determinants of innovation that have an impact on the regional competitiveness, represented by RCI, within the 28 Member States of the EU.
    - Comparing the national and regional results in terms of the validated determinants of innovation.
    - Formulating policy recommendations in order to increase national and regional competitiveness by supporting the validated determinants of innovation.

3. The Relationship between Competitiveness and Innovation at the National and Regional Level within EU

This section of the paper is focused on the methodology used to test the connection between the competitiveness and the determinants of innovation, both at national and regional level within the European Union's area. Further on, the results of the econometrical analyzes are exposed, along with the comparison between the determinants of innovation validated at the national and the regional level in EU.

Methodologically, the paper includes several econometrical analyzes where the dependent variable is represented by the national, respectively regional index of competitiveness, and the independent variables are referring to determinants that reflect innovation. The research process requested using the documentary analysis and consulting several international and European reports. At the national level three cases were developed. The dependent variable is represented by WCI, GCI or CCI and the independent variables are considered the dimensions, respectively indicators composing IUS. At the regional level, the RCI is on the position of dependent variable, while the indicators included in RIS are the independent variables. The intensity of the innovation – competitiveness connection is tested

through regressions, by using the Eviews programme. In all the four cases, three at national level and the last one on the regional level, several tests (R-squared, Ramsey, White etc.) were applied in order to test the correctitude and stability of the multiple regressions that were developed. Most of the tests registered good results, and if a problem was encountered, this issue is specified and solved in the corresponding case.

Case 1

Firstly, the correlation between the competitiveness at the national level in the European Union, represented by the WCI, and the eight dimensions of the IUS is tested. Extracted from the report elaborated by the IMD World Competitiveness Center in 2014 (IMD, 2014), the WCI reflects the situation of the year 2013. On the other side, the dimensions of innovation are mainly associated to the year 2012.

WCI_{2013}= 24.54131286 + 41.42490488*HR + 38.05768989*IASSETS

The econometrical analysis confirms that the 'human resources' and 'intellectual assets' have a positive impact on the WCI, implicitly on the national competitiveness in the EU. The regression is well defined with an R-squared of 77%, making the determinant variable significantly explained through the explainable variables. Their coefficients indicate that the national competitiveness within the EU in a certain year is predicted to increase by 41.4 when the 'human resources' from the previous year goes up by one, and increase by 38 when the 'intellectual assets' from the previous year goes up by one, and is expected to be 24.5 when all the variables are zero.

The second situation reveals the connection between the WCI and the indicators associated to the two dimensions of innovation previously confirmed.

WCI_{2013}= 15.90901748 + 7.945120612*NDG + 0.8027726633*POP_T_ED + 2.18268833*COM_DESIGN

Only three out of the total seven indicators of the two dimensions of innovation were confirmed; each of them registering a p-value less than 0.05.

"New doctorate graduates", "population aged 30-34 having completed tertiary education", "community designs" and the free term have a positive impact on the national competitiveness in the EU. The strongest impact is represented by the first variable, namely when 'new doctorate graduates' goes up by one within a certain year, then the national competitiveness of the following two years increases by 7.94.

Case 2

Extracted from the Global Competitiveness Index 2014-2015 (Schwab, 2014), the dependent variable is reflecting the situation on the national competitiveness for the period 2013-2014. Similar to case 1, the dimensions of innovation are mainly concentrated on the year 2012.

$GCI_{2013-2014}$= 3.35255477 + 1.054443102*HR + 1.628281786*IASSETS

The coefficients associated to 'human resources' and 'intellectual assets' variables show that the national competitiveness within the EU in a certain year is predicted to increase by 1.05 when the 'human resources' from the previous year goes up by one, and increase by 1.63 when the 'intellectual assets' from the previous year goes up by one, and is predicted to be 3.35 when all the variables are zero (Iosif, 2014 b).

$GCI_{2013-2014}$ = 3.532798965 + 0.009238330553*POP_T_ED + 0.4771957769*PCT_PAT_AP + 0.02498496308*COM_TRADEMARK

Overall, the applied tests confirm that the regression is good, even though the number of validated explanatory variables is limited. "Population aged 30-34 having completed tertiary education", "PCT patents applications", "community trademarks", and free term are the variables that explain the national competitiveness within the EU. Considering that the first and the third variables are reflecting the situation of the year 2012 and the 'PCT patent applications' are representing the situation of the year 2010, the results validate that the variables have a positive impact on the national competitiveness, but due to the difference in the reference years the intensity of the connection is low.

Case 3

Both the CCI and the dimensions of innovation reflect the situation of the year 2012.

CCI_{2012}= -1.455910675 + 1.227930104*FS + 1.683188549*IASSETS

Several tests are conducted in order to validate the regression, and the problem of homoscedasticity is encountered when applying the White test. Consequently, the function "White Heteroskedasticity-Consistent Standard Errors & Covariance" (Becker, 2013) is used in order to allow the data to be interpreted.

The equation reveals that if "finance and support" or "intellectual assets" variables goes up by one unit, then the competitiveness at the national level in the EU is predicted to increase 1.23, respectively 1.68. Moreover, when the variables are considered to be zero, then the national competitiveness is expected to be -1.46 (Iosif, 2014a).

CCI_{2012}= -1.880204682 + 1.296360725*RD_PUB + 2.769676764*VCI + 0.061431124*COM_TRADEMARKS

Three out of the six indicators associated to the two validated dimensions of innovation were confirmed, namely "R&D expenditure in the public sector", "venture capital investment", and the "community trademarks". The results indicate that these three independent variables have a positive impact on the national competitiveness. The 'venture capital investment' has the highest impact, generating an increase of 2.8 on the national competitiveness when it goes up by one unit.

Case 4

The current RCI 2013 is using data from the period 2009-2011, while the indicators of the RIS are more focused on the year 2010. At the regional level (NUTS2) only an equation is projected, because the independent variables are represented only by indicators of innovation. Due to the lack of data corresponding to the regional competitiveness at the NUTS 2 level, several representative countries had to be extracted from the analysis, namely Belgium, Bulgaria, Germany, Greece, France, Austria and United Kingdom. Even through more than 40 regions were excluded, 126 observations are enough in order to proceed with the econometrical analysis.

The regional case testing the connection between competitiveness and innovation raised the major problem of heteroskedasticity, and the function of 'White Heteroskedasticity-Consistent Standard Errors & Covariance' had to be applied. Consequently, only the independent variables that had a p-value under 0.05 could be interpreted.

COMP_REG = -1.042892846 + 0.7440246876*RD_PUB + 0.5645051723*RD_BUS + 1.794870846* PCT_PAT_AP - 0.06626375233*SME_MO + 0.1270593164*EMP - 0.09144817196*SALES

The "R&D expenditure in the public sector", ‚R&D expenditure in the business sector', and ‚PCT patent applications' are confirmed to have a positive impact on the regional competitiveness in EU, while the free term a negative influence. Even though the regression is well defined, with an R-squared of 58%, half of the variables included within the regression are not validated. Several improvements have to be brought to this regression.

4. Comparison between Cases

Table 1 reflects the differences between the three cases focused on the connection between competitiveness and indicators of innovation at the national level within

the EU. Within the header of the table, in brackets, the dependent variable corresponding to each case is specified.

Table 1. Comparison between the cases at the national level

Case 1 (WCI)	Case 2 (GCI)	Case 3 (CCI)
New doctorate graduates per 1000 population aged 25-34	Percentage population aged 30-34 having completed tertiary education	Community trademarks per billion GDP
Percentage population aged 30-34 having completed tertiary education	PCT patent applications per billion GDP	R&D expenditure in the public sector as % pf GDP
Community designs per billion GDP	Community trademarks per billion GDP	Venture capital investment as % of GDP

Source: own representation

Even though within all three linear regressions the same independent variables of innovation were used, differences in terms of validated indicators have appeared. Consequently, the econometric tests validated only several particular variables in relation to each dependent variable reflecting the national competitiveness in EU. The common point between the first and the second case is represented by the "Percentage population aged 30-34 having completed tertiary education", while the "Community trademarks per billion GDP" constitutes the similarity between the second and the third case. Overall, there are more differences between the cases, than common issues. Even though there is correlation between the three indexes reflecting the national competitiveness, they do not present the same sensibility to the determinants of innovation. Behind their sensibility could lay the methodology used for calculating the index of the national competitiveness and how ‚innovation' has been included and quantified as a component of the index itself.

The indicators of innovation that were validated as having impact at both the national and regional level in EU are represented by the "R&D expenditure in the public sector as % pf GDP' and the 'PCT patent applications per billion GDP". These common points reflect that innovation acts through similar instruments on the regional competitiveness as in the case of the national competitiveness in EU. In the latter case, more indicators of innovation were confirmed due to the variety of indexes used for the determinant variable. 'R&D expenditure in the business sector as % pf GDP' is a distinctive feature of the regional competitiveness compared to national competitiveness in EU, indicating the involvement of the business sector in developing innovative activities by investing in R&D at the regional level. The "power" of the R&D expenditure in the business sector on

competitiveness is already confirmed at the regional level, and is stimulated to increase, by various policies and programmes, to generate positive impact also at the national level in the EU.

Implications of the innovation's impact on competitiveness and policy recommendations for stimulating innovation to enhance competitiveness at the national and regional level (NUTS2) within the EU represents the main subject of the following section of the paper. It is worth highlighting that there is no universal policy to innovation, and local specificities and capabilities should be considered when formulating cohesion policies in the innovation's area (ESPON & Politecnico di Milano, 2012a). Consequently, the policy recommendations are generally formulated based on the validated determinants of innovation. The recommendations may prove their efficiency and effectiveness as long as they are applied in accordance with the specificities and needs of each region/country of the EU.

5. Policy Recommendations

Many authors (Fraunhofer ISI, 2014; IEG, 2013; EC, 2013; UNECE, 2012; Arslan & Tathdil, 2012; EU, 2010; Polt et al., 2008) have formulated policy recommendations that support innovation for increasing competitiveness. A selection of the most relevant measures in line with the results of the current paper are exposed in the following list. The list points out barriers to which solutions and adequate recommendations are allocated.

The lack of commercial exploitation and precise scope of the Research and Development (R&D) results (UNECE, 2012; Polt et al., 2008)	Enhance direct innovation impact of the R&D

- Developing follow-up projects that are focused on the commercial side of the research results;
- Constant supporting of the sponsorship of R&D programmes;
- Commercialization of the stock of inventions and innovations;
- Investing in the quantity and quality of human resources available for R&D and involved in activities that improve competitiveness (IEG, 2013);
- Emphasizing the emergence of private institutions and initiatives additionally to the government support programmes for innovation;
- Increasing R&D opportunities in promising industrial sectors.

Minuses in the environment to support innovation policy and, implicitly, innovation-based enterprises	Develop regulatory and institutional environment conducive to innovation

- Investing in basic, secondary, and tertiary education and skills development in the area of high-tech products and services;
- Investing in science and technology (IEG, 2013);
- 'Supporting public investment in R&D that focuses on improving efficiency and relevance to end users, as well as strengthening the use of research results in public policy decisions' (IEG, 2013, p. 25);
- Showing an openness to foreign technologies and to cross-border cooperation in innovation (UNECE, 2012);
- Facilitating the access to finance at the various stages of enterprise development;
- 'Provide flexible financing arrangements to encourage innovative firms to undertake risks in developing new products, processes, and services' (IEG, 2013, p. 26);
- Allocating the corresponding microcredits to stimulate innovation within enterprises;
- Developing appropriate market regulations for innovative products and government procurement;
- Supporting transparency and accountability in public spending and investment;
- Promoting independence of the judiciary;
- Harmonizing the 'relevant laws and regulations in accordance with international norms, transparent and stable rules, low costs and simple procedures governing the registration and operation of enterprises' (UNECE, 2012);
- Encouraging the wide use of information and communication technologies (UNECE, 2012).

Costly and fragmented patent system in EU (EU, 2010)	Creating a single innovation market (EU, 2010)

- Reforming the patent system in Europe (EU, 2010);
- Developing a single EU patent system;
- Using formal intellectual property protection mechanisms;
- Developing stable property rights including intellectual property rights.

6. Conclusions

Being aware of the importance and impact of innovation on competitiveness, both advanced and developing economies should allocate the necessary resources for developing an adequate "innovation policy" and formulate appropriate "national innovation systems" (Naude et al., 2011). Moreover, increasing competitiveness at various levels through innovation is a major objective of the Europe 2020 strategy that has developed seven flagship initiatives, out of which the "Innovation Union" is dedicated to measures that 'improve framework conditions and access to financing research and innovation' (ESPON & Universidade de Santiago de Compostela, 2012, p. 83). In order to support this initiative, both public and private environment should come with measures for improving competitiveness (Popovici, Călin, 2014).

A competitive European economy that is allocating the adequate importance to innovation has the capacity of maintaining and rising a growing standard of living, while thinking about the future generations (ESPON & Universidade de Santiago de Compostela, 2012).

Based on the obtained results, policy makers, business, and academic community should pay a special attention to the validated determinants of innovation for enhancing a long-term economic growth. Concluding, stakeholders involved in stimulating and implementing innovation at the national level in EU should be more focused on developing "human resources", "intellectual assets" and "finance and support".

Recent studies (Moreno, Suriñach, 2014, p. 26) have revealed that, beyond the traditional determinants and the indicators included in indexes, innovation is influenced, by "the embeddedness of agents in their local networks" and by "their degree of connectedness with the outside world". Quantifying these variables and including them into indexes associated to innovation could be a real challenge for econometricians. The influence of these determinants on innovation indirectly generates effects on the competitiveness at various levels. Moreover, the current trends indicate that the spatial dimension is essential when analysing innovation. In order to reach a coherent cohesion policy, strong normative strategies should be built based on the capacity of a region to turn knowledge and innovation into regional growth, and the regional specificities into innovation patterns (ESPON & Politecnico di Milano, 2012a).

As a future direction of research, a comparative analysis between the validated determinants of innovation with an influence on the national and/or regional level would be useful. The purpose would be to formulate appropriate policy recommendations to enhance competitiveness by a proper stimulation of innovation at each level.

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